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# Table of Contents

## E70 Power Windows

Subject	Page
Introduction .....	3
System Overview .....	4
System Circuit Diagram .....	5
Examples of the Window Switch Signal Path .....	6
Driver's Door .....	6
Front Passenger's Door .....	6
Rear Doors .....	6
System Components .....	7
Control Elements .....	8
Driver's Door Switch Cluster .....	8
Window Switch Signal Evaluation .....	8
Control Units .....	9
Car Access System 3 .....	9
Footwell Module .....	9
Junction Box Control Unit .....	9
Remote Control .....	9
Power Window Motors .....	9
Principles of Operation .....	10
Opening and Closing .....	10
Toll Function .....	10
Comfort Opening and Closing .....	12
With Remote Control .....	12
Via the Driver's Door Lock Barrel .....	12
With Comfort Access .....	12
Anti-Trap Mechanism .....	13
Panic Mode .....	13
Load Shut-Down, Terminal 50 .....	14
Thermal Protection .....	14
Service Information .....	15
Initialization .....	15
Via Window Switches .....	15
Via the BMW Diagnosis Equipment .....	15

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# Power Windows

Model: E70

Production: From Start of Production

# OBJECTIVES

After completion of this module you will be able to:

- Understand and explain the power window system used in the E70 X5

# Introduction

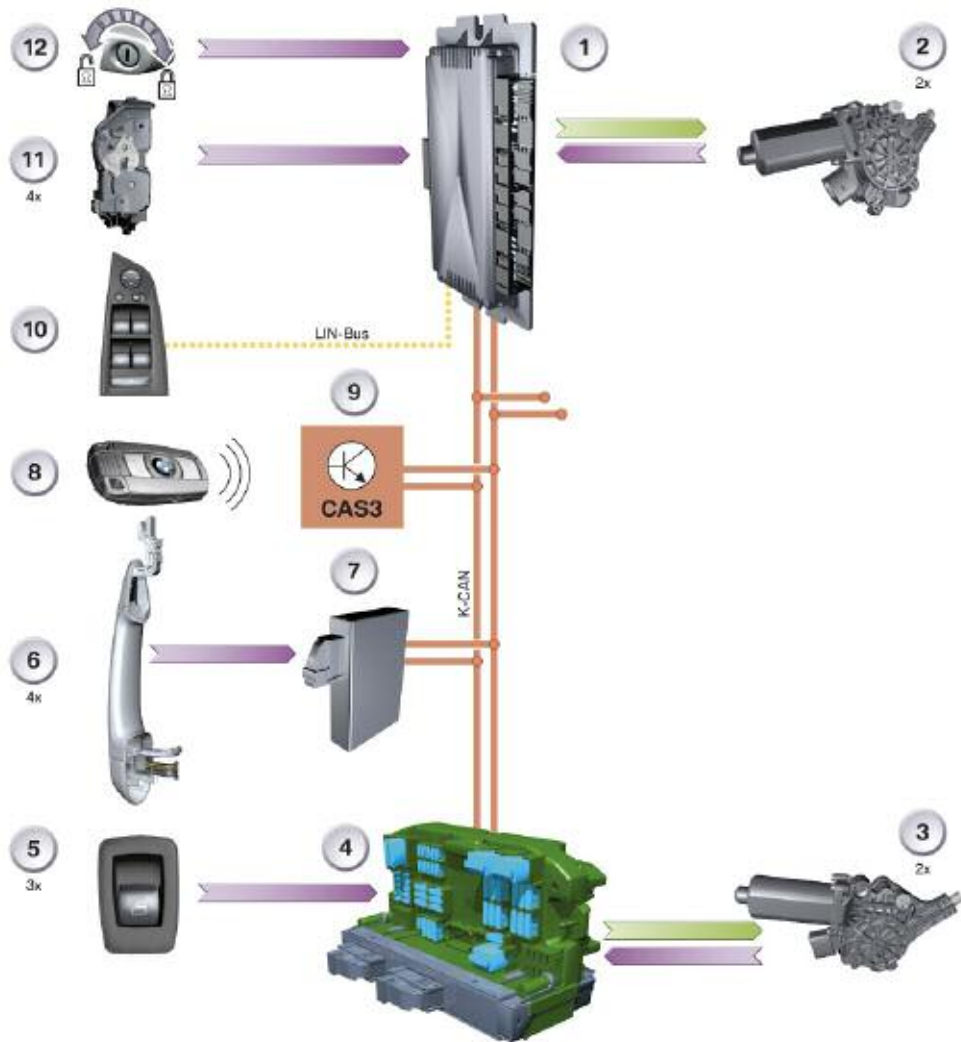
The E70 has been fitted with electric power windows since the start of series production.

All power windows are equipped with an indirect anti-trap mechanism through the use of hall sensors mounted inside each motor assembly. The electric power windows have the following functions:

- Opening and closing
- One-touch / Toll opening and closing
- Comfort opening and closing

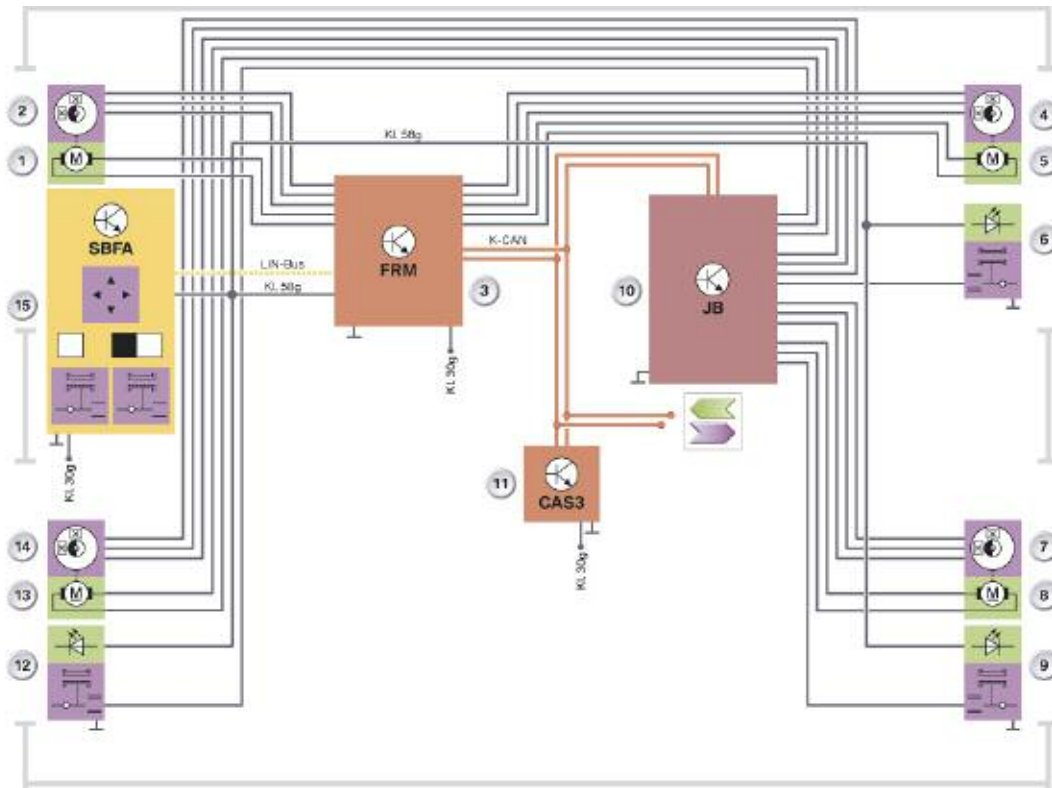


# System Overview



Index	Explanation	Index	Explanation
1	Footwell module	8	ID transmitter
2	Power window motor, front doors	9	Car Access System 3 CAS 3
3	Power window motor, rear doors	10	Driver's door switch cluster
4	Junction box control unit	11	Lock with door contact
5	Power window switch, driver's side rear/pas-senger side front and rear	12	Lock cylinder, driver's door
6	Outside door handle for Comfort Access	K-CAN	Body CAN
7	Comfort Access	Bus-LIN	Local interconnected network bus

## System Circuit Diagram



Index	Explanation	Index	Explanation
1	Driver's door power window motor	11	Car Access System 3 CAS 3
2	Indirect anti-trap mechanism, driver's door power window	12	Power window switch, driver's side rear
3	FRM footwell module	13	Power window motor, driver's side rear
4	Indirect anti-trap mechanism, passenger side front power window	14	Indirect anti-trap mechanism, driver's side rear power window
5	Power window motor, passenger side front	15	SBFA driver's door switch cluster
6	Power window switch, passenger side front	K-CAN	Body CAN
7	Indirect anti-trap mechanism, passenger side rear	KL. 30g	Terminal 30 switched
8	Power window motor, passenger side rear	KL. 58g	Terminal 58 switched
9	Power window switch, passenger side rear	LIN-Bus	Local interconnected network bus
10	JB junction box control unit		

K-CAN Signals on Roof Function Center			
In/Out	Information	Source/sink	Function
In	Status of terminal 50	Car Access System 3 >FZD	Interruption in adjustment procedure for power window
In	Outside temperature	Outside temperature sensor	Value used to determine the thermal protection of the power window motors
In	Comfort Closing	Outside door handle > Comfort access	Comfort closing of the power windows
Out	Anti-trap mechanism deactivated	Roof function center > Instrument cluster	CC message display
Out	Anti-trap mechanism deactivated	Junction box control unit > Instrument cluster	CC message display

The Car Access System 3 (11) issues the enable to actuate the power window motors (1, 5, 8 and 13).

If a power window switch is then activated, the footwell module (3) (front power window motor) or the junction box control unit (10) (rear power window motor) executes the desired request.

#### Examples of the Window Switch Signal Path

The following examples of a signal path show the path taken by the signal before the power window motor opens or closes the window. A requirement is that the Car Access System 3 has issued the enable for operation of the power windows.

##### Driver's Door

When the power window switch for the window in the driver's door or front passenger 's door is operated, the signal is routed via the LIN bus to the footwell module. The footwell module drives the corresponding power window motor.

The signal is routed from the driver's door switch cluster via the LIN bus to the footwell module when the power window switches for the windows in the rear doors are operated.

The footwell module sends the signal via the K-CAN to the junction box control unit. The junction box receives the signal and activates the corresponding power window motor.

##### Front Passenger's Door

The signal is routed to the junction box control unit when the power window switch in the front passenger's door is operated.

The junction box control unit sends the signal via the K-CAN to the footwell module. The footwell module controls the power window motor.

##### Rear Doors

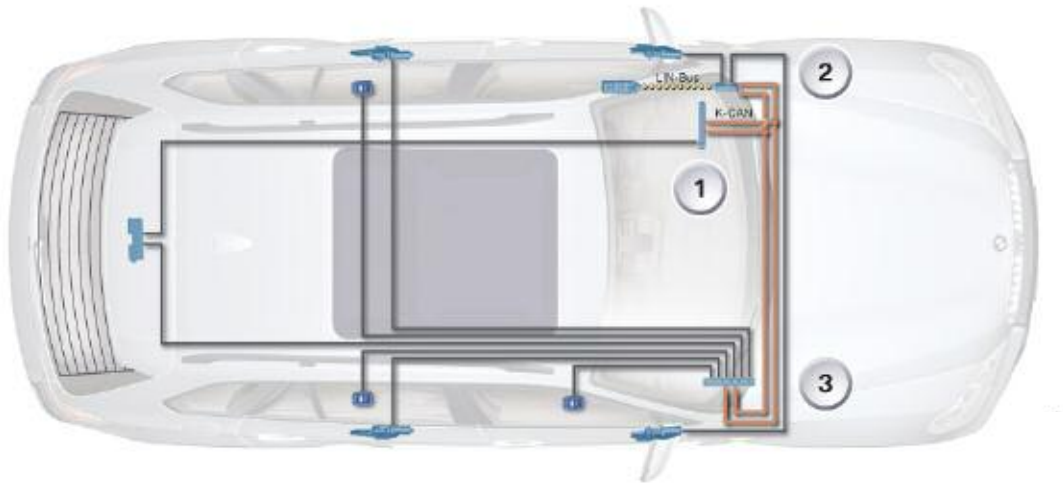
When the power window switches in the rear doors are operated, the signal is routed to the junction box control unit. The junction box control unit drives the power window motor.

# System Components

The following graphic shows all the components of the power window system together with the respective control units and control elements.

The following components are described:

- Control elements
- Control units
  - Car Access System 3
  - Footwell module
  - Junction box control unit
- Power window motor



Index	Explanation	Index	Explanation
1	Car Access System 3	3	Junction box control unit
2	Footwell module		

## Control Elements

### Driver's Door Switch Cluster

The driver's door switch cluster is connected via the LIN bus to the footwell module.

For opening or closing, the power window switch has two notch positions. The first notch position is used for the manual power window function. The second notch position (press) is used for the toll function of the power windows.

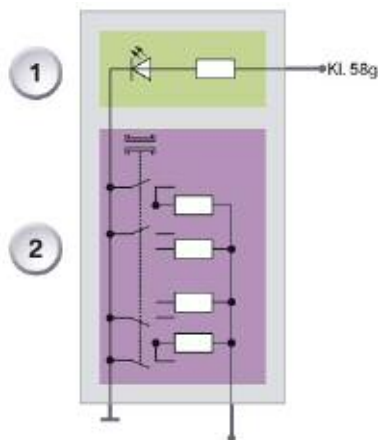
The power window switches are resistance coded and switched to earth. The following graphic shows the principle of a resistance coded switch.



### Window Switch Signal Evaluation

The signals of the power window switch in the driver's door switch console are evaluated directly by the driver's door switch cluster and transferred to the footwell module via the LIN bus.

The signals from the power window switches in the front passenger's door as well as the power window switches of the both rear doors are evaluated by the junction box control unit.



Index	Explanation
1	Illumination of power window switch
2	Resistance-coded switch



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## Control Units

### Car Access System 3

The Car Access System 3 is the central control unit for opening and closing the windows. Therefore, it issues the enable to operate the power windows. During the engine start phase, it is not possible to move the power windows. This means more energy from the battery is available for the starter during engine start-up.

### Footwell Module

The relays for the power window motors for the front doors are installed in the footwell module.

The footwell module provides information on the status of the door contacts and the driver's door lock cylinder.

The footwell module also provides the power window switch and the driver's door switch console with information on the "Terminal 58g ON" status.

### Junction Box Control Unit

The relays for the power window motors for the rear doors are installed in the junction box control unit.

### Remote Control

The remote control can initiate the comfort opening/comfort closing procedure for the power windows.

Note: The ID transmitter can also perform the functions of the remote control. The comfort opening and closing function with the ID transmitter is therefore the same as with the remote control.

## Power Window Motors

The power window motors are equipped with Hall sensors that generate signals during motor operation. These signals serve the purpose of monitoring motor operation and are evaluated for the anti-trap mechanism.

The signals are evaluated in the footwell module and the junction box control unit.

# Principles of Operation

The functions of the power windows on the E70 are:

- Opening and closing
- Opening and closing with toll function
- Comfort opening and closing
- Indirect anti-trap mechanism
- Panic mode
- Load shut-down at terminal 50
- Thermal protection of power window motors

## Opening and closing

The Car Access System 3 has the central control function for electric opening and closing of the power windows.

This means that the Car Access System 3 issues the enable to open and close the power windows. The footwell module and the junction box control unit actuate the power window motors and monitor the motor speed of the respective power window motor. This means the footwell module or the junction box control unit can respond to the following operating situations:

- Trapping
- Overheating of the power window motor
- Seizing of the power window motor.

## Opening and Closing

The corresponding power window motor is activated in OPEN or CLOSE direction by pressing or pulling the power window switches to the first notch position. The power window motor remains active until the corresponding power window switch is released.

To ensure the power window is closed securely, the power window motor is briefly driven to block status at the limit stop.

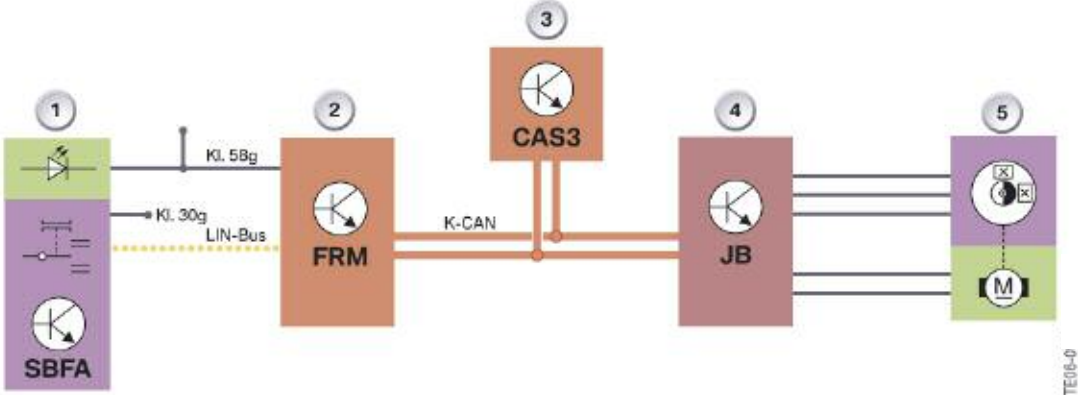
### Toll Function

The toll function is implemented for all power windows. The corresponding power window motor is driven in the OPEN or CLOSE direction by pressing or pulling a power window switch beyond the limit stop.

The power window motor moves the window automatically until it is completely open or closed. Power window operation is stopped when the power window switch is pressed or pulled again.

By way of example, the opening and closing procedure for one of the rear windows is illustrated by the signal path in the following graphic. The opening or closing function is initiated from the driver's door switch cluster.

Example: Opening or closing the rear window in the E70



Index	Explanation	Index	Explanation
1	SBFA power window switch in driver's door switch cluster	LIN-bus	LIN bus
2	FRM footwell module	K-CAN	Body CAN
3	Car Access System 3 CAS 3	KL. 30g	Terminal 30g
4	JB junction box control unit	KL. 58g	Terminal 58g
5	Power window motor		

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## Comfort Opening and Closing

Comfort opening or closing can be performed with the remote control/ID transmitter via the door lock in the driver's door or the outside driver's/passenger's door handle.

**Comfort opening with remote control** The comfort opening function is initiated by unlocking the vehicle with the remote control and keeping the button pressed for longer than 5 seconds.

Initially, the front windows are opened, followed after a short time delay by the rear windows and the panorama glass roof.

The signal from the remote control is picked up by the Car Access System 3 via the remote control receiver.

The Car Access System 3 issues the enable to operate the power windows and initiates the comfort opening function. The footwell module and the junction box control unit correspondingly activate the power window motors.

### With Remote Control

The comfort closing function is initiated after locking the vehicle with the remote control and keeping the button pressed for longer than 5 seconds. Initially, the panorama glass roof is closed followed after a short time delay by the rear/front windows.

If the folding exterior mirrors option is installed, the mirrors are folded in simultaneously as the rear windows are closed.

### Via the Driver's Door Lock Barrel

There are two Hall sensors installed in the door lock for the purpose of opening and closing the vehicle. The Hall sensors enable the footwell module to detect the position of the mechanical key or of the spare key in the lock barrel.

The key must be turned to the open or close position to initiate the comfort opening and closing function. The comfort opening or closing function is initiated when the key is held in this position.

The footwell module sends the request via the K-CAN. On conclusion of the corresponding check, the Car Access System 3 initiates the comfort opening or closing procedure.

### With Comfort Access

In connection with Comfort Access, the comfort closing function is triggered via the driver's/passenger's outside door handle.

It is sufficient to touch the sensitive area of the outside door handle in order to trigger the comfort closing function via the door handle.

Comfort closing is triggered if the sensitive area is touched for longer than 5 seconds. The ID transmitter must be within an approximately 2 m radius of the vehicle.

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## Anti-Trap Mechanism

Essentially, the indirect anti-trap mechanism does not prevent an object being trapped but rather it limits the trapping force to maximum 80 N. The power window motor is reversed on exceeding this trapping force.

The footwell module and the junction box control unit monitor the activated power window motors. The indirect anti-trap mechanism for the front windows is activated by the footwell module. The indirect anti-trap mechanism for the rear windows is activated by the junction box control unit.

The indirect anti-trap mechanism in the E90 is based on the evaluation of the Hall pulses from the power window motors. The speed is derived from the Hall pulses of the power window motors. Speed fluctuations within certain ranges trigger the indirect anti-trap mechanism so that the windows are opened.

Operation of the power window switches is ineffective while the windows are in the process of opening.

If no operable anti-trap mechanism is detected as the result of defective Hall sensors, the window can only be operated in jolts. The power window is in emergency mode and must be reinitialized. A Check Control message will be displayed.

## Panic Mode

Panic mode is triggered by overpulling - releasing- overpulling (overpulling = pulling beyond limit stop) the power window switches.

It is necessary to release and overpull the switch again as the anti-trap mechanism is still active the first time the switch is overpulled.

Overpulling the power window switch the second time within 4 seconds closes the window with maximum force.

Note: The indirect anti-trap mechanism is no longer active in this case. The window closes at the maximum closing force and does not reverse.

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## Load Shut-Down, Terminal 50

To protect the battery, operation of the power windows is interrupted during the vehicle start procedure.

The Car Access System 3 revokes the enable for power window operation in order to interrupt current operation of the power windows. The signal is received by the footwell module and junction box control unit via the K-CAN.

The power window switches must be pressed again following an interruption in operation. The corresponding function is not executed if the power windows are operated during the start procedure.

The enable for operation of the power windows is not issued until the start procedure has been completed.

## Thermal Protection

The footwell module and the junction box control unit monitor the motor temperature.

The motor temperature is determined based on the outside temperature, motor running time and the time the motor is stationary (not operative).

Each motor can be switched off individually to prevent the power window motors overheating during operation of the power windows). The motor is then deactivated for a defined period of time. The thermal protection facility does not prevent the windows being opened in the case of trapping. Once started, a power window function is not interrupted by the thermal protection facility.

In panic mode the window can still be closed even when the thermal protection function is active.

# Service Information

## Initialization

The front and rear power windows can be initialized via the power window switches or the BMW diagnosis system.

### Via Window Switches

The following procedure must be performed to initialize the system:

- Completely close window by pulling the power window switch beyond the limit stop.
- Briefly interrupt pulling the power window switch and then pull the switch upwards again for approximately. 1 second.

### Via the BMW Diagnosis Equipment

The power windows can be initialized as part of an initialization job using the diagnosis system. A detailed description of the initialization procedure is provided in the BMW diagnosis system.

Note: The power windows can only be moved in jolts if not initialized.